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SURP Summary
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Envisioning a SETI project for the ngVLA

The search for extraterrestrial intelligence (SETI) relies on our ability to detect and recognize technosignatures—signs of activity from a technologically advanced civilization. We expect that, similar to ourselves, extraterrestrial civilizations may utilize electromagnetic radiation in the radio bands to send and receive information. These technosignatures are expected to have very narrow bandwidth (~ 1 Hz), display a Doppler drift due to relative accelerations (from orbits and rotations) between the signal source and our receivers, and not be explainable as Earth-based radio-frequency interference (RFI). With so many potentially habitable exoplanets in our galaxy and an entire spectrum of frequencies where there might hide a narrow signal, our SETI efforts must strategically span large portions of the sky and observe in a wide range of radio frequencies. The Next Generation Very Large Array (ngVLA) promises to become an invaluable tool for SETI once it is operational in the following decade thanks to its tremendous sensitivity and its ability to observe a wide range of radio frequencies.

The sensitivity and potential scope of a SETI project with the ngVLA compared to that of previous or ongoing projects are illustrated in Figure 1. Searches that are more recent are generally greater in extent and in sensitivity than older ones. ngVLA stands out for its superior sensitivity and its ability to better search higher radio frequencies. The ngVLA's most sensitive receiver would have the ability to detect a signal comparable to our own from over 300 pc away. Of note, considering our own galactic disc is over 30 kpc in diameter, even our most ambitious search cannot look beyond our immediate neighbourhood for civilizations that are similar to us.

A SETI project with the ngVLA will likely be commensal, meaning it will be performed using data that was initially collected for other science goals. As such, targets, frequencies, and observing times will be predetermined by these other science goals. SETI projects should optimally aim to detect a high maximum drift rate as a means of identifying potential technosignatures. The ability to detect high drift rates with ngVLA will be limited by computing power; the search must run at least as fast as the observation data is collected. Detection of a technosignature is highly dependent on the chosen signal-to-noise ratio (SNR) threshold. A lower threshold allows us to pick up more candidates but also results in more RFI detection and a slower search algorithm. These are a few of the parameters that need to be decided for an optimal search as the ngVLA comes closer to construction.

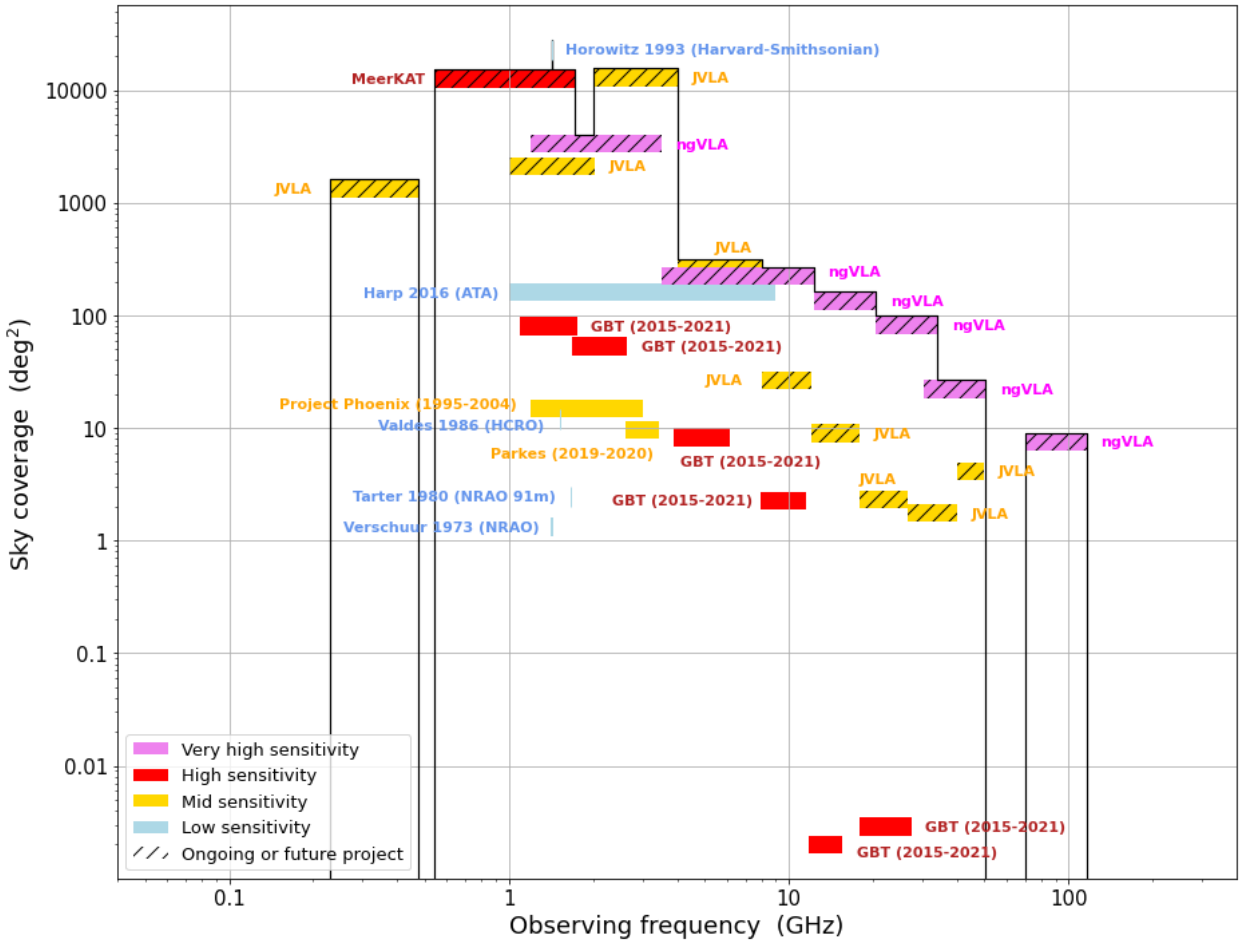

Figure 1: Extent of SETI projects in frequency space and sky area